

FSMLabs Hard Real-Time Software Documentation

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What it is: [RTLINUX Pro](#) consists of a is a POSIX hard-real-time kernel (RTCore) offering low microsecond worst case latencies that can run Linux in its spare time.

Additional components include -

- [PSDD](#) for memory protected real-time threads and optional frame scheduler;
- [LNET](#) for real-time sockets networking on both Ethernet and 1394 Firewire;
- [ControlsKit](#) for XML/RPC access to real-time control and data plus a Java based graphical user console; and the
- [VxIT](#) library emulating VxWorks functions for porting legacy applications.
- [RTCore BSD](#): The BSD OS may be run as the general purpose operating system instead of Linux for licensing or technical reasons.

Features: the RTCore real time executive offers the POSIX 1003.13 (Pthreads) Application Programmers' Interface plus a large number of built in methods for constructing sophisticated real-time control applications including safe methods for communicating with non-real-time processes running under the Linux or BSD client.

RTCore [supports](#): SMP multiprocessing, VME, ARM9, PowerPC, x86, MIPS, XSCALE, and many PC-104 boards.

Linux and BSD running under the RTCore executive have a large and well known set of features and drivers.

Benefits: The decoupled architecture of RTCore prevents non-real-time software from interfering with the operation of the real-time system and provides a clean, modular environment for control software.

The result is reliable low microsecond worst case real-time plus all the sophistication and standard applications and drivers of the Linux/BSD clients.

Successes:

- **Pratt & Whitney** used a machine-in-loop simulator hosted on RTLINUX and [PSDD](#). The simulator was used on everything from the original physics model simulation to controlling the [Joint Strike Fighter F-134 Jet Engine](#) test stand.
- This software is now being used on multiple other projects at **United Technologies** and UT says it shaved 5% off the development time.
- **Sandia Labs** has used RTCore on several critical projects.
- **ATOS-Origin** has ported software for the **European Space Agency**.
- **BBN**, creators of the original Arpanet (Internet), used RTLINUX Pro to deliver a critical program to the original Bell Labs organization that runs multiple high end Power PC processor modules with dual, real time Gigabit Ethernet plugged into a single VME carrier card.

FSMLabs ported the LNET real time networking package to their processor cards and network interface components to enable this project.

- **Lucent** also adopted RTLinux Pro for some critical real time networking applications, and BBN bid and won three new programs utilizing RTLinux Pro.
- **Harris Corporation** is fielding an agile battlefield network based on RTLinux Pro for the [WIN-T](#) program. RTLinux Pro was originally used on notebook computers in golf carts with modified WIFI cards to quickly prototype the project. The software has now been moved to quad Power PC VME boards in mobile chassis. FSMLabs supplied the hardware and software for the first articles at Harris to speed development.
- **General Dynamics Land Systems** in the Detroit area used MATLAB and connected it to RTLinux Pro to prototype a system for automatically compiling simulation models into RTLinux code and downloading it to PC104 based tank turret controllers at the push of a single button.
- They won a Future Combat Systems contract (estimated \$2.2B total value) based on their rapid prototyping and other technical merit. James (Russ) Bates was responsible for the prototyping work on RTLinux Pro. A [technical paper](#) describes their real time target creation process.
- **NASA John Glenn Research Center** has scheduled two of our hands-on RTLinux Pro JumpStart classes, tailored to the requirements of the attendees and their application areas.
Attendees left with evaluation software if they did not already own a copy so they could “do their homework”. They did, and at least three experiments adopted RTLinux Pro. Alan Richard (arichard@grc.nasa.gov) was the coordinating contact. See our website for more [case studies](#).
- **Atos Origin:** "VxIT enabled us to port our existing application to RTLinux Pro using unchanged source code," recounts Erik Leussink of [Atos Origin](#), a large European business and technology integrator. "VxIT and RTLinux provided a more cost-effective alternative to our legacy platform without any loss of reliability or performance. Moreover, support from FSMLabs has been great and vital to meeting target deadlines."
- [Other case studies](#) are listed on the FSMLabs web site.

Contexts in which it is best used: Wherever there is a technical advantage to the combination of a full UNIX system and hard-real-time control, RTLinux Pro is up to 1000 times more responsive than Linux or other General Purpose O/S solutions.

Whenever

- Efficient use of software tools and technical support on multiple hardware platforms is important.
- Rapid Prototyping in a reliable environment is important.
- Leveraging the resources of Open Source for general purpose applications such as data bases, user interfaces, networking, and more is important.
- Equipment cost, weight, or space is important, since RTLinux Pro allows for the Human Interface Computer to also be the real time controller and the development host.
- Leveraging of low cost or high performance Commercial Off The Shelf hardware to perform hard real time processing is important.
- Booting your entire system in well under half a second is important ([RTLinux Quickboot Option](#))

- Easily porting from legacy Real Time O/S is necessary. (Our [VxIT](#) is the first of several libraries that offer efficient emulation of other RTOS environments to allow for rapid porting of code by simple re-compilation).
- Having e-mail, telephone, and on-site support made available under support agreements for as little as 3 hours or for long term on site support is important.
- Reducing overall program risk by working directly with a technology innovator whose “new” technology is as recent as Open Source and whose mature, critical core technology is still carefully crafted by its original designers and ships with regression tests and benchmarks ready for the customer to run.

Compare with alternative known products or technologies.. Proprietary and other traditional real-time operating systems do not have as robust as solution to the interaction of non-real-time, and real-time software and cannot provide the non-real-time features and performance of Linux and BSD.

“Embedded Linux” vendors don't have a hard real-time solution and have a consumer electronics focus that leads to less rigorous quality assurance.

There are fundamental engineering reasons why RTCore costs less too: primarily, FSMLabs does not need to develop features that are supported on Linux and BSD.

FSMLabs licensing is also straightforward and flexible.

What will a successful collaboration look like?

What will you as the technology provider do? We provide customized, on-site or off-site [training](#), and anything from email/telephone support to on-site development.

What should the development team do? [Check out the articles on on web site](#). Sign up for our hands-on [RTLlinux Pro JumpStart class](#) and use the e-book as appropriate for further understanding. Run the supplied benchmarks, examples, and regression tests on your hardware. Develop your applications using standard Linux or BSD tools.

Acquire [RTLlinux Pro](#) and use it to implement and deliver your project on time and under budget.

How will you, as technology provider, work together with the development team to ensure a successful collaboration? We [adjust to the requirements of the project](#). Many projects need close to zero support. Some need extensive training and design assistance. Some require project management skills that we can provide.

Some programs require “hot button” immediate on-site assistance, which we can also supply.

The RTLlinux Per Programmer License, not limited to one project or one target architecture is ideal for an R&D environment:

- The default RTLlinux Pro user license is per programmer, and does not expire (update subscriptions are available but not mandatory.) This works well for organizations performing many R&D projects which can share the programmers and the licenses.
- Up to two changes of target CPU per year are covered under the update subscriptions, so new projects can use different hardware.